

WHAT IS CLAIMED IS:

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1. A method for fault diagnosis in a vehicle comprising the steps of:  
partitioning a vehicle model into a plurality of subsystems, each subsystem comprising one or more modules;  
associating a fault detector unit with each module in each subsystem;  
defining a residual evaluation method for each subsystem;  
evaluating data from said fault detector units in accordance with said residual evaluation method for each subsystem; and  
diagnosing a fault in accordance with said evaluated data.
2. The method of claim 1 wherein the step of defining a residual evaluation method for each subsystem comprises the step of defining a residual evaluation method selected from the group consisting of parity space method, observer method, and parameter identification method.
3. The method of claim 1 wherein the step of partitioning a vehicle model into a plurality of subsystems comprises the step of partitioning said vehicle model into a core subsystem and an external subsystem.
4. The method of claim 3 wherein the step of partitioning said vehicle model into a core subsystem comprises the step of partitioning said vehicle model into a vehicle dynamics module, a tire module, a powertrain module, a steering module, a suspension module, and a brake module.
5. The method of claim 3 wherein the step of partitioning said vehicle model into an external subsystem comprises the step of partitioning said vehicle model into an environmental module, a driver module, a sensor module, a brake controller

module, a suspension controller module, and a communication module.

6. The method of claim 3 wherein said subsystem modules are selected from the group of modules consisting of vehicle, tire, powertrain, steering, suspension, brake, environmental, driver, sensor, brake controller, suspension controller, communication, engine controller, fuel, air intake, combustion, exhaust, crank-shaft, transmission, coupling, supervisory controller, electric machine, controller, batteries/supercapacitors, tank, pump, servo-value, and cylinder modules.
7. The method of claim 3 wherein said plurality of subsystems comprises a handling system, a propulsion system, and an auxiliary system.
8. A system for problem diagnosis in a vehicle comprising:
  - a plurality of residual evaluation units;
  - a plurality of fault detector units in communication with said plurality of residual evaluation units, each of said plurality of fault detector units adapted to communicate fault data to at least one of said residual evaluation units; and
  - a supervisor unit adapted to analyze evaluated data from plurality of residual evaluation units and to diagnose a problem in accordance with said data from said plurality of residual evaluation units.
9. The system of claim 8 each of said residual evaluation units evaluates fault data in accordance with a residual evaluation method selected from the group of evaluation methods consisting of parity space method, observer method, and parameter identification method.
10. The system of claim 8 wherein said plurality of residual evaluation units comprises a brake/suspension/steering residual evaluation unit, a tire/vehicle dynamic

residual evaluation unit, and a powertrain/driver residual evaluation unit.

11. The system of claim 8 wherein each of said plurality of fault detector units comprises a primary residual generator adapted to generate fault data.
12. The system of claim 11 wherein said primary residual generator is adapted to generate a primary residual representing the error between a measured and calculated variable.
13. The system of claim 8 wherein each of said residual evaluation units comprises a secondary-residual generator, a residual evaluator, and a decision unit.
14. The system of claim 8 wherein each of said plurality of fault detector units comprises a model associated with a module.
15. The system of claim 14 wherein said module is selected from the group consisting of vehicle, tire, powertrain, steering, suspension, brake, environmental, driver, sensor, brake controller, suspension controller, communication, engine controller, fuel, air intake, combustion, exhaust, crank-shaft, transmission, coupling, supervisory controller, electric machine, controller, batteries/supercapacitors, tank, pump, servo-value, and cylinder modules.
16. A vehicle comprising:
  - a fault detector unit associated with a module in said vehicle adapted to output a residual;
  - a residual evaluation unit adapted to receive and process in accordance with a residual evaluation method a residual from said fault detector unit; and
  - a supervisor unit adapted to receive output from said residual evaluation unit and diagnose a fault in accordance with said output from said residual evaluation unit.

evaluation unit.

- 17. The vehicle of claim 16 wherein said fault detector unit comprises a model and a primary residual generator adapted to generate a residual in accordance with output from said model.
- 18. The vehicle of claim 16 wherein said module is associated with a core subsystem.
- 19. The vehicle of claim 16 wherein said module is associated with an external subsystem.
- 20. The vehicle of claim 16 wherein said module is selected from the group of modules consisting of sensor, brake controller, suspension controller, communication, brake, driver, steering, vehicle, suspension, powertrain, tire, environmental, engine controller, fuel, air intake, combustion, exhaust, crank-shaft, transmission, coupling, supervisory controller, electric machine, controller, batteries/supercapacitors, tank, pump, servo-value, and cylinder modules.
- 21. The vehicle of claim 16 wherein said residual evaluation unit comprises a secondary residual generator, a residual evaluator, and a decision unit.
- 22. The vehicle of claim 16 wherein said residual evaluation method is selected from the group of evaluation methods consisting of parity space method, observer method, and parameter identification method.
- 23. The vehicle of claim 16 wherein said module is in the handling system.
- 24. The vehicle of claim 16 wherein said module is in the propulsion system.
- 25. The vehicle of claim 16 wherein said module is in the auxiliary system.